■ General Description

The MST1160 is a monolithic device intended for building a complete flashing unit for two wheel vehicles. The device is connected between the battery positive terminal (VCC pin) and a mechanical switch to the right and/or left bulbs. As soon as the series switch connects the OUT pin to the bulbs, the device begins to turn on/off with a 50% duty cycle. An external capacitor connected between the CEXT pin and the OUT pin stores energy for powering the device during the ON phase. When a low load is detected (output current lower than Idf), flashing frequency is automatically doubled.

■ Features

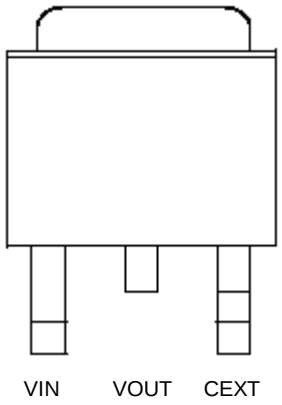
- Complete direction indicator in a 3 pin package
- Double frequency flashing in low load conditions
- Cycle by cycle overtemperature shutdown
- Break down voltage up to 60V
- On chip oscillator ensures stable flashing frequency
- Over current protection
- Thermal shutdown protection
- On resistance as low as 60mohm typical

■ Pin Descriptions

Number	Symbol	Description
1	VIN	Battery positive terminal
2	VOUT	Output terminal
3	CEXT	Capacitor terminal

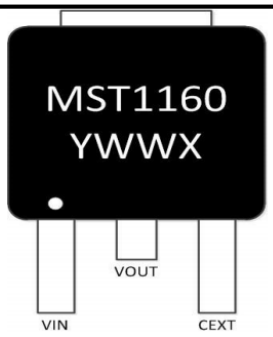
■ Pin Configuration

TO252

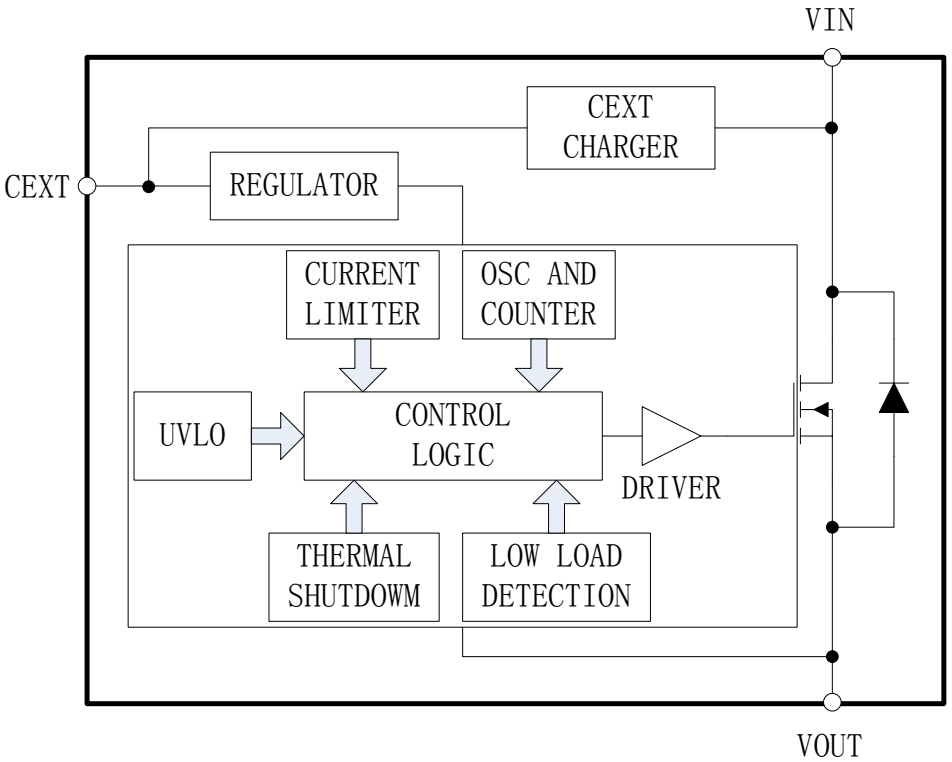


■ Package/Order Information

Package/Order Information

Order Part Number		
MST1160TQ TQ: TO252 1160: Product Name MST: Company Name	Package Outline	
	Minimum Package	TO252 2500/Reel
	Marking	MST1160 433X 1160: Product Code X: Internal Code. Variable. 433: 4-2014; 33-the 33th week of this year MST: Company Code

■ Block Diagram



■ Absolute Maximum Ratings

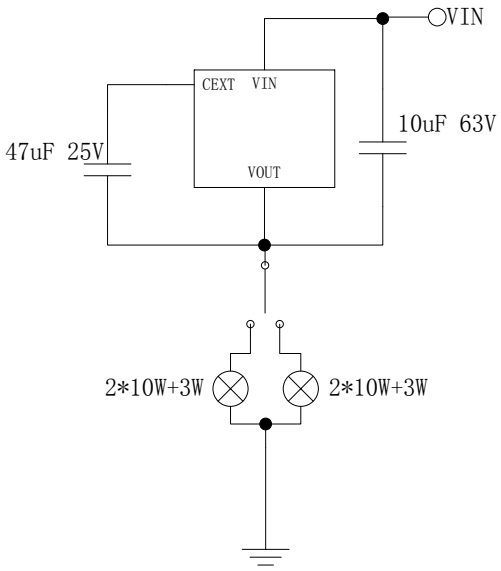
Symbol	Parameter	Value	Unit
Vin	DC Supply Voltage	40	V
Vdd	CEXT Capacitor Voltage	24	V
I_{peak}	Maximum DC Drain Current (Tc=25℃,Vin=12V)	Internally Limited	A
Vesd	Electrostatic Discharge (Human Body Mode)	2000	V
	Electrostatic Discharge (Machine Mode)	200	V
PL	Power Dissipation (Tc=25°C)	46	W
Tj	Junction Operating Temperature	Internally Limited	℃
Tstg	Storage Temperature	-40--150	℃
Rthj-case	Thermal Resistance Junction-case	3.33	℃/W
Rthj-amb	Thermal Resistance Junction-ambient	100	℃/W

■ Electrical Characteristics （VIN=12V，TC=25°C unless otherwise specified）

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
DC Supply Voltage	Vin		9		24	V
Under voltage Lockout Threshold	Vdd_{NORM}	VCEXT rising	6.3	6.5	6.7	V
Under voltage Lockout Hysteresis	Vdd_{UVLO}	VCEXT falling	1.4	1.5	1.7	V
On State Resistance	RDS(ON)	Vdd=5V;Ic =1.6A		60	80	mΩ
Self Oscillating Frequency	Focs		1.33	1.42	1.5	Hz
Drain Current Limit	Ilim	Rload<100mΩ		10		A
Overtemperature Shutdown	Tjsh		125	140		℃
Overtemperature Reset	Tjrs		100	115		℃
Turn-on Current Slope	dI/dt(on)	Rload=20Ω		0.02		A/us
Turn-off Current Slope	dI/dt(off)	Rload=20Ω		0.02		A/us
Double Frequency Flashing Threshold	$I_{DF}1$	Vin=9.5V(*)	816	940	1066	mA
Double Frequency Flashing Threshold	$I_{DF}2$	Vin=15.5V(*)	1062	1240	1417	mA

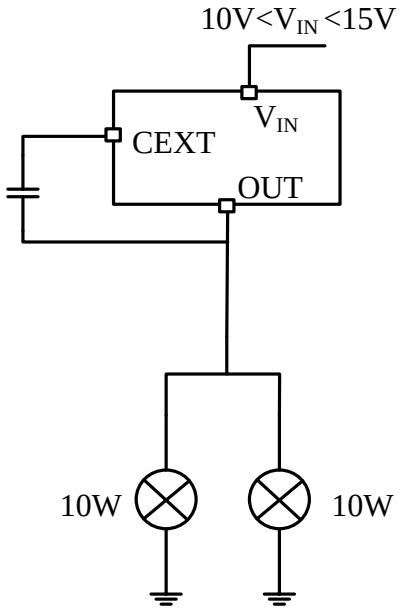
(*) See double frequency test configuration

■ Typical Application Circuit

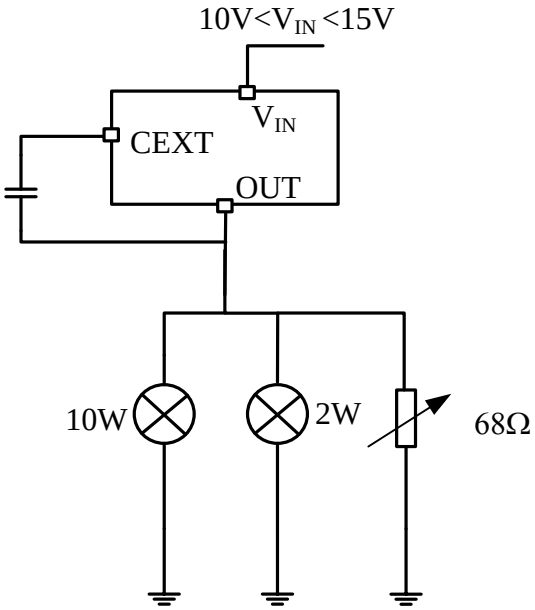


➢ Application Information

DOUBLE FREQUENCY TEST CONFIGURATION



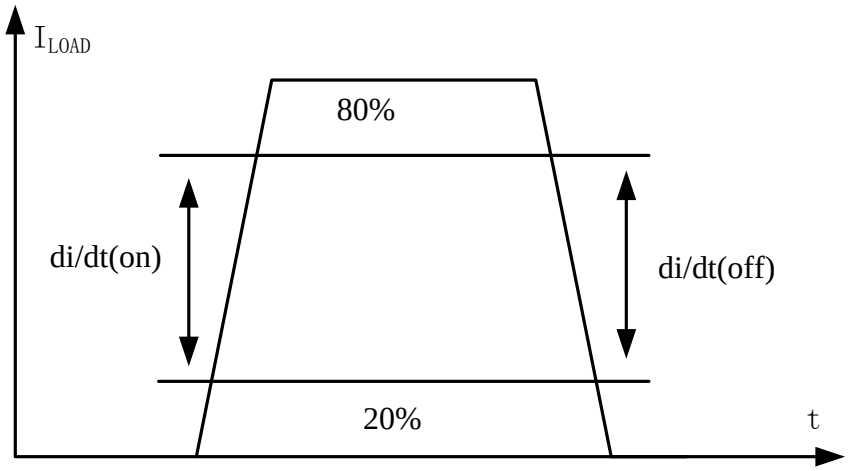
Test1: no defect, minimum load.
The MST1160 must oscillate at f=F_{OSC}.



Test2: defect, maximum load.
The MST1160 must oscillate at f=2Fosc

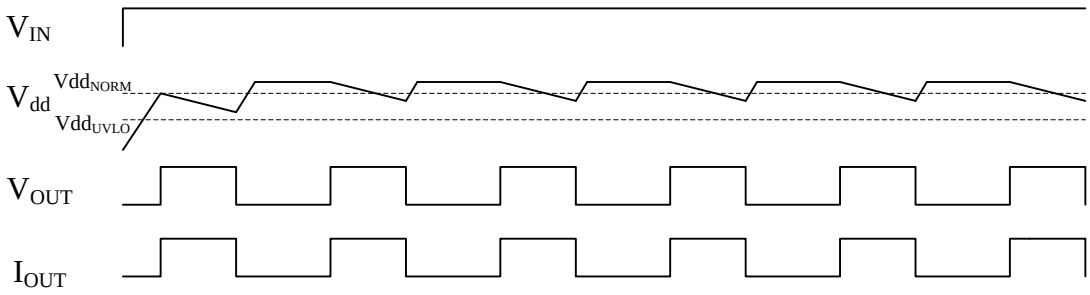
■ Typical Performance Characteristics

SWITCHING CHARACTERISTICS

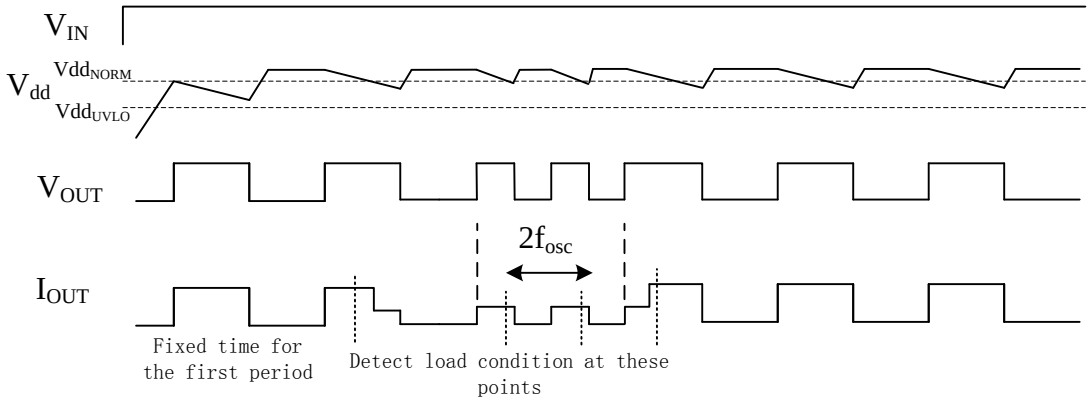


- **Waveforms**

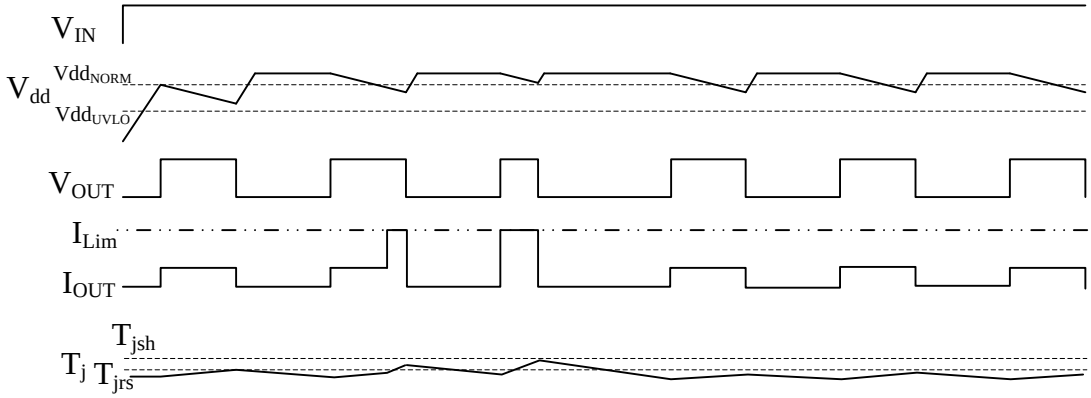
NORMAL OPERATION



LOW LOAD CONDITION (*)



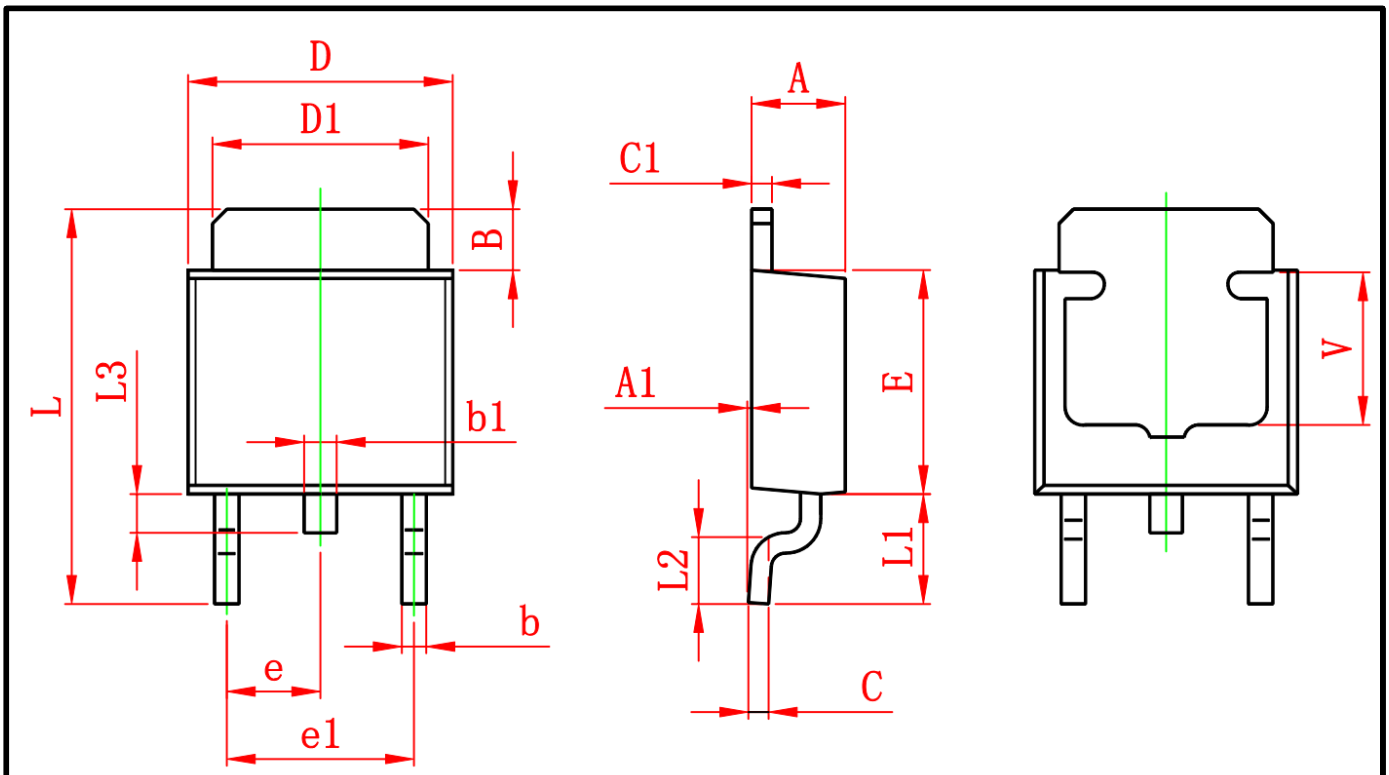
OVERLOAD AND OVERTEMPERATURE SHUTDOWN (**)



(*) For the first period after power on, the frequency is fixed at Fosc; for every cycle after, the frequency is determined by the load condition. The MST1160 detect load condition at about 170ms after every cycle begins (the power mos turn on), and decide the frequency of the current cycle.

(**) When overtemperature occurs, the power mos will be turned off immediatelly. When the temperature drops to Tjrs, if the time is within the first 22ms of the on period or the on period of the first period, then the power mos will be turned on again; otherwise the power mos will remain off for the rest of this period. When an overtemperature occurs, the current period will be 1/Fosc to ensure the chip has enough time to cool down.

■ Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP.		0.091 TYP.	
e1	4.500	4.700	0.177	0.185
L	9.500	9.900	0.374	0.390
L1	2.550	2.900	0.100	0.114
L2	1.400	1.780	0.055	0.070
L3	0.600	0.900	0.024	0.035
V	3.800 REF.		0.150 REF.	